

Before the
Federal Communications Commission
Washington, D.C. 20554

FILED/ACCEPTED

OCT - 8 2009

Federal Communications Commission
Office of the Secretary

In the Matter of)

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Amendment of Section 15.253 of the
Commission's Rules Regarding Operation
within the Band 76.0-77.0 GHz (vehicle radar
systems)

RM-11555

REPLY COMMENTS OF THE

TOYOTA MOTOR CORPORATION

TOYOTA MOTOR NORTH AMERICA, INC.

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Submitted: October 8, 2009

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Pursuant to Section 1.405 of the Federal Communications Commission's (FCC's) Rules,¹ Toyota Motor North America, Inc. (TMA), on behalf of Toyota Motor Corporation (TMC) hereby submits reply comments in response to comments filed in above-captioned proceeding.²

The record in this proceeding generally supports TMC's petition for rulemaking to amend 47 C.F.R., Part 15, Section 15.253, "Operation within the bands 46.7 GHz and 76.0-77.0 GHz,"³ to enable the introduction of new vehicular technologies in the United States that can help enhance collision avoidance and safety, and also contribute to driver convenience. Comments filed by Denso Corporation, Denso International America, Inc., the Strategic Automotive Radar Frequency Allocation (SARA), Mercedes-Benz USA, LLC, Fujitsu Ten Technical Center, USA, Inc., and the Association of International Automobile Manufacturers, Inc. (AIAM), all support TMC's request that the Commission amend Section 15.253 of its Rules to adopt reasonable and technically supportable limits for radiated emission limits in the 76-77 GHz frequency band allocated for vehicular radar systems.

¹ 47 C.F.R. §1.405.

² See "Consumer & Governmental Affairs Bureau Reference Information Center Petition For Rulemakings Filed," Public Notice, Report No. 2896, RM-11555 (August 26, 2009).

³ 47 C.F.R. §15.253.

TMC has also reviewed the comments filed by the National Radio Astronomy Observatory (NRAO). TMC welcomes NRAO's support for basing emission level standards for vehicular radars in the U.S. on consideration of interference. However, TMC would like to address NRAO's concerns regarding interference to radio astronomy facilities. NRAO has concluded that "it is premature to propose new rules for the operation of these radars" based on its assumption that these devices would cause harmful interference to facilities operating in the radio astronomy service (RAS).⁴

First, as a general matter, the Commission has already recognized that RAS interference concerns such as those expressed by NRAO can be relatively easily accommodated without jeopardizing the important public safety benefits that vehicular radar systems operating at 76-77 GHz provide. In 2004, the Long-Range Automotive Radar Frequency Allocation Group (LARA) outlined the feasibility of sharing between short range automotive radar (SRR) systems and RAS, observing that:

1) the number of millimeter wave observatories are expected to remain limited; 2) RAS receivers are usually located on high mountains or in remote areas, and access to RAS telescopes is controlled at distances of at least one kilometer; 3) SRRs are typically located less than one half-meter above the ground, increasing signal attenuation by ground clutter that limits above-horizon radiation; 4) the narrow beamwidth of SRRs and radio telescope receiving antennas results in very low potential for mutual coupling that would result in interference; 5) interference mitigation for RAS can be accomplished through the erection of fences and other local shielding; and 6) that at frequencies this high, radio wave propagation is essentially line-of-sight, meaning SRR sensors would have to point directly at a RAS telescope to cause interference.⁵

⁴ See Comments of the National Radio Astronomy Observatory, RM-11555 (September 24, 2009) ("NRAO Comments").

⁵ *In the Matter of Amendment of Part 2 of the Commission's Rules to Realign the 76-81 GHz band and the Frequency Range Above 95 GHz Consistent with International Allocation Changes*, 19 FCC Rcd 3212, 3218 (2004) ("2004 76-81 GHz Order").

The Commission agreed with these observations, noting that “[f]or the reasons indicated by LARA, we conclude that, as a practical matter, sharing conflicts are highly unlikely in any portion of these bands,”⁶ and that “RAS observatories are few, and are sited and designed to be protected from sources of interference.”⁷ Virtually all of these observations remain applicable today. TMC submits that it would not serve the public interest to refrain from facilitating the continued innovation and development of life-saving and valuable vehicular radar services in the 76-77 GHz band via the requested rulemaking proceeding based on NRAO’s interference concerns.

Turning to the specific concerns raised in the NRAO Comments, NRAO bases its concerns largely on the results of a study of the effects on vehicular radar systems on radio astronomy stations that was issued by the European Conference of Postal and Telecommunications Administrations (CEPT) in 2004.⁸ NRAO acknowledges that EIRP levels proposed in the TMC petition have been adopted by other countries. However, NRAO states that CEPT countries that have adopted these power levels have “recognized that equipping vehicles with mm-wave radars presents the likelihood of interference to radio astronomy” and that “all new cars carrying [24 GHz] radars in Europe have since 2008 also been equipped with GPS-based geo-location systems which automatically mute the radars within specified coordination zones around certain radio astronomy observatories.”⁹

⁶ *Id.*

⁷ *Id.* See also *In the Matter of Amendment of Parts 2, and 15 of the Commission’s Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications*, 15 FCC Rcd 10515, 10517 (2000) (noting Commission’s statement that “because emissions in the 76-77 GHz frequency range tend to be highly focused and directional while radio astronomy equipment discriminates against off-beam signals such as those from moving vehicles. . .there would be little likelihood of interference to radio astronomy operations”) (citation omitted).

⁸ “Compatibility Of Automotive Collision Warning Short Range Radar Operating At 79 GHz With Radiocommunication Services.” ECC Report No. 56, Electronic Communications Committee (ECC) within the European Conference of Postal and Telecommunications Administrations (CEPT). Stockholm 2004.

⁹ NRAO Comments at 1-2.

Furthermore, NRAO continues, this is the same scenario discussed in the CEPT report for higher-frequency (*e.g.*, 79 GHz) radars.¹⁰

TMC notes that the situation described by NRAO for Europe presently only applies to 24 GHz (ultra wideband) SRR systems.¹¹ TMC's research indicates that because of this decision, which limits the use of 24 GHz SRR, many automotive manufacturers do not use 24 GHz (ultra wideband) SRR, and actually only a very limited number of vehicles using such systems have been also equipped with muting GPS systems. TMC also notes that the systems it proposes to introduce are long-range radar (LRR) systems operating in the 77 GHz band. Such systems have already been placed in vehicles in worldwide, and TMC is not aware of any automotive manufacturer offering a muting GPS system in vehicles equipped with these high-frequency LRR systems.

TMC also is aware that in the United States various automobile manufacturers offer 24 GHz SRR in certain vehicles with no concurrent installation of muting GPS. In addition, several manufacturers offer 77 GHz LRR devices (only for vehicular "in motion" operation) that do not incorporate GPS muting. In both of these cases TMC is not aware of any reports of electromagnetic interference (EMI) to radio astronomy stations.

The conclusion by NRAO that it is "premature" to change the emission limits in Section 15.253 would seem to imply that NRAO has no objection to the current emission limits for vehicular radar systems. This would apply to both the higher "in motion" or lower "not in motion" power density criteria currently mandated by the Commission. With respect to EMI to radio astronomy stations it would make no difference whether a vehicle is in motion or not in motion.

One of the primary proposals of the TMC petition is to remove the distinction between "in

¹⁰ *Id.* at 2.

¹¹ "ECC Decision of 12 November 2004 on the frequency bands to be designated for the temporary introduction of Automotive Short Range Radars," Electronic Communications Committee, ECC/DEC/(04)10, 2004/545/EC and 2005/50/EC, amended 5 September 2007, available at <http://www.erodocdb.dk/Docs/doc98/official/pdf/ECCDEC0410amended.PDF>.

motion” and “not in motion” criteria for vehicles using these systems so that uniform emission limits are defined. This suggests that the current emission limits of approximately 48.3 dBm (68.3 dBm peak power) for forward-looking radar and approximately 45.3 dBm (65.3 dBm peak power) for side-looking or rear-looking radar have not thus far caused concern for NRAO.¹² The limits proposed by TMC for adoption by the Commission are those recommended by ETSI and others (55 dBm peak power and 50 dBm average power), and, in terms of peak power, TMC would like to emphasize that these levels are actually *lower* than those currently specified in Section 15.253. For this reason, we believe that NRAO is unrealistic in its assessment of the magnitude of the changes to emission limits proposed by TMC.

NRAO maintains that vehicles equipped with vehicular radar to date have achieved “low market penetration.”¹³ However, TMC disagrees with this assessment, and TMC’s research indicates that over 170,000 Toyota vehicles have been equipped with LRR technology since 2003. During this period TMC is aware of *no* documented reports of EMI from these systems to radio astronomy stations.

NRAO also expresses concern that a beam from one of these devices may “find its way” down or near the boresight of such an antenna at close range. However, TMC cannot visualize a scenario where such a situation would occur, given that radio astronomy antennas are pointed upward and vehicular radar beams are close to parallel to the horizon (approximately zero degrees or slightly above the horizon).

NRAO quotes the conclusions of the CEPT report that co-existence between vehicular radar at 79 GHz and the radio astronomy service is dependent on the “aggregated impact” of SRR devices

¹² As noted in the TMC Petition, FCC emission limits in Section 15.253 refer to average power density and TMC converted these values to power levels for comparison purposes. A peak power limit for these systems is 20 dB higher than the limits for average power (*see* Section 15.35(b), footnote 12 of the TMC Petition).

¹³ NRAO Comments at 2.

transmitting in the direction of a radio astronomy station.¹⁴ The model used in the CEPT report suggests that “regulatory measures” (such as automatic “deactivation” mechanisms) are necessary to enable such co-existence.¹⁵ But “aggregated impact” suggests an assumption that the beams from many such devices could be nearby or pointing down the boresight of a radio astronomy antenna simultaneously. Once again, TMC believes that this is an extremely unlikely scenario. Furthermore, regulatory measures suggested by CEPT, such as mandating GPS muting systems in all cars equipped with vehicular radar could increase costs of such systems to the point of making their introduction impractical and unaffordable for many consumers as well as such systems could cause driver confusion when vehicles automatically shut down.

NRAO maintains that TMC has not provided a sufficient technical basis for assessing the interference potential of high-frequency vehicular radar systems and that the petition does not discuss such issues as number of radars per vehicle, location of radars on vehicles, radar beam patterns, etc. Much of this information is proprietary. However, TMC can provide the following general information to address these issues. As discussed in TMC’s petition, both forward and rear-looking radar devices could be installed in vehicles. Side-looking radar would also be a possibility but probably is not as important. Therefore, for most vehicles it would be expected that at least two radar devices would be installed for LRR. The locations of these devices would obviously be near the front and/or rear bumpers of a vehicle. Beam-width would be small since high-gain antennas (on the order of 22 dBi or higher) are used for these devices with limited angles of elevation. TMC is willing to provide more detailed proprietary information on its LRR systems as needed.

Finally, the NRAO criticizes certain aspects and conclusions of the report from the

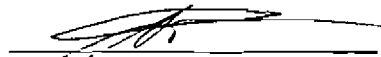
¹⁴ NRAO Comments at 1.

¹⁵ *Id.* at 2.

Australian Communications Authority (ACA) discussing the potential for EMI from vehicular radar systems that was referenced in TMC's petition. However, it is TMC's understanding that current regulations in Australia for vehicular radar systems do not require that muting GPS systems be installed in vehicles to protect radio astronomy stations. Furthermore, TMC is not aware that any incidents of EMI to radio astronomy stations from these devices have been reported in the Australian market.

In conclusion, TMC believes that concerns raised by the NRAO have not been verified by research, and, with supporting comments from other parties, TMC strongly recommends that the Commission amend section 15.253 of its Rules and Regulations to adopt reasonable and technically supportable limits for radiated emission levels in the 76-77GHz frequency band as proposed in TMC's Petition. Specifically, TMC proposes that the Commission amend its rules to eliminate the "not in motion" criteria in Section 15.253(b)(1) and replace the existing applicable power density limits, specified in Sections 15.253 (b)(2) and (b)(3), with a uniform limit for peak power not to exceed 55 dBm EIRP in conformance with existing international standards and recommendations.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Christopher J. Tinto", is written over a horizontal line.

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October 8, 2009